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PROCESS FOR IMPROVING THE RESISTANCE OF
POLYCHLOROPRENE RUBBERS IN THE PRESENCE
OF AGGRESSIVE MEDIA, ESPECIALLY FREEZING
AGENTS AND OILS

by

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PROCESS FOR IMPROVING THE RESISTANCE OF POLYCHLOROPRENE RUBBERS IN THE PRESENCE OF AGGRESSIVE MEDIA, ESPECIALLY FREEZING AGENTS AND OILS

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<small>11. ABSTRACT</small> <p>The purpose of this invention is to develop a process that enables the polychloroprene rubbers to resist corrosive materials especially refrigerants and oils, to be so improved that the polychloroprene rubbers, preferably in the form of sealing elements, can be used for moving parts, and to increase the degree of cross-linking without increasing the cross-linking agent too much. In accordance with the invention the task was solved by the fact that chloroprene rubber articles which are cross-linked chemically with standard cross-linking agents in the well-known manner were exposed to energy radiation, for example, electron rays or gamma rays in which the dosage amounted to a given radiation. The energy of the energy-rich radiation must be matched to the geometric dimensions of the body to be radiated in such a way that a somewhat homogeneous dosage distribution is attained over the body to be radiated. If necessary, in order to attain homogeneous dosage distribution a multistaged radiation can be used.</p>	

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Furthermore, by attaining a comparatively high degree of cross-linking and a corresponding thinning of elastic phase, the swelling, caused, for example, by Freon-22 refrigeration machine oil mixtures, is considerably reduced so that at least a reliable seal is guaranteed in connection with dead load cases.

Increasing the degree of cross-linking by increasing the concentrations of the cross-linking agent is, however, limited because an excessive amount of the cross-linking agent leads to faster aging and consequently hardening. In the final analysis elastomers are also only slightly resistant to refrigerant oil mixtures. [Translators note: The following two sentences are incomplete.] Nitrile rubber mixtures are, of course, oil resistant but nevertheless the resistance of the refrigerant for the most part is not sufficient. Polysulfides have a good refrigerant and also oil resistance but the elastic characteristics are unsatisfactory. Even highly fluorinated elastomers which are characterized by a good temperature and solvent resistance, for the most part are not satisfactory with regard to their permanent deformation in refrigerant oil mixtures.

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The invention concerns a method of improving the resistance of polychloroprene rubbers in the presence of aggressive media, especially freezing agents and oils, advantageously when the polychloroprene rubber is used in the form of a sealing element for seals.

As is well-known, polychloroprene rubber is chemically cross-linked by adding cross-linking agents, e.g., mercaptoimidazole. When used in refrigeration engineering to seal against refrigeration agents and oil mixtures, this rubber is attacked not only by the freezing agent such as halogenated hydrocarbons in the process of extraction and swelling but it is also greatly affected by the refrigeration machine oils as a result of the swelling. This then softens the polychloroprene rubber and its service life is greatly reduced. In the past, this fact has been countered when the refrigeration machine oil which is always found in the refrigeration cycle, is added to the polychloroprene rubber as a softener and in so doing the swelling equilibrium is quickly attained. Refrigeration machine oil as a softener, however, leads to an extraordinary retardation of the vulcanization process and the typical optimal characteristics of polychloroprene rubber are not attained.

It is also well-known that the characteristics of any elastomers change due to the influence of ionized radiation.

The purpose of this invention is to develop a process that enables the polychloroprene rubbers to resist corrosive materials especially refrigerants and oils, to be so improved that the polychloroprene rubbers, preferably in the form of sealing elements, can be used for moving parts.

The purpose of the invention is to increase the degree of cross-linking without increasing the cross-linking agent too much.

In accordance with the invention the task was solved by the fact that chloroprene rubber articles which are cross-linked chemically with standard cross-linking agents in the well-known

manner were exposed to energy radiation, for example, electron rays or gamma rays in which the dosage amounted to $2 \cdot 10^7$ to $4 \cdot 10^7$ rad. The energy of the energy-rich radiation must be matched to the geometric dimensions of the body to be radiated in such a way that a somewhat homogenous dosage distribution is attained over the body to be radiated. If necessary, in order to attain homogenous dosage distribution a multi-sided radiation can be used.

In accordance to the invention sealing elements that are made of polychloroprene rubbers can be used in connection with refrigerant-oil mixtures in connection with which a real improvement in the service life is attained.

The invention is to be explained in greater detail in the following by means of a sighted example. Sealing rings with a cross-sectional diameter of 5 mm that are made of chemically chain-linked polychloroprene rubbers were subjected to radiation from two sides with electrons of 1 Mev energy level in which the dosage was $3 \cdot 5 \cdot 10^7$ rad.

In the following table the characteristics of the radiation chemical recross-linked specimens of polychloroprene rubber are compared with the characteristics of the specimens that were only chemically cross-linked but of the same material prior and following swelling for 168 hours in a freon refrigeration oil mixture at 10°C .

Characteristics of the rubber	Chemically		Radiation		Cross linked	
	before swelling	after swelling	before swelling	after swelling	before swelling	after swelling
Elongation at break (%)	94	73	53	25	53	25
Impact elasticity (%)	20	50	20	48	20	48
Shore A hardness	86	70	89	80	89	80
Mass change (%)	-	32.70	-	22.30	-	22.30
Length change (%)	-	10.60	-	7.80	-	7.80
Volume change (%)	-	36.70	-	25.10	-	25.10

Patent Claim:

1. Process for improving the resistance of polychloroprene rubbers against corrosive materials, especially refrigerant oils characterized by the fact that chloroprene articles which were chemically chain linked in the well-known manner with standard chain linking agents are subjected to radiation rich rays in which the dosage amounted to $2 \cdot 10^7$ to $4 \cdot 10^7$ rad.
2. Process in accordance to claim No. 1 that is characterized by the fact that electron beams were used as the radiation source.
3. Process in accordance with claim No. 1 characterized by the fact that gamma rays were used as the radiation source.
4. Process in accordance with claim No. 1 to 3 characterized by the fact that in order to attain a homogenous dosage distribution rays were used from several sides.